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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 10/511,811
Filing Date: October 19, 2004
Appellant(s): ZAJCEV ET AL.

Michael Marcin
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed 30 July 2008 appealing from the Office action mailed 19 March 2008.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

6,558,231	TAYLOR	5-2003
6,402,931	ZHOU et al	6-2002
5,833,835	GIMAEV et al	11-1998

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claim 1, 10, and 13-15 are rejected under 35 U.S.C. 102(e) as being anticipated by Taylor (6,558,231) and Zhou et al. (6,403,931 as incorporated by reference therein (Taylor col. 2 line 62).

Regarding claim 1, Taylor teaches electropolishing of a metal surface using a pulsed current where the pulsed current/voltage comprising an anodic pulse (unipolar pulse) followed by a cathodic pulse (inverse of the unipolar pulse, Zhou et al. col. 4 line 62 – col. 5 line 19) while maintaining a gap between a workpiece and an opposing electrode (col. 2 lines 59-67, Zhou et al. col. 11 line 45-49), and further teaches a two step machining process where initial pulse duration and amplitude differs from the second such that it can more effectively machine different size asperities on the workpiece by initially setting the conditions to machine larger asperities (shown in figure 4A macroasperities [404] and microasperities [406]) and then adjusting then adjusting the pulse duration and amplitude to machine microasperities [406] most effectively with corresponding waveform profiles shown in figures 2 (corresponding to the initial machining of macroasperities [404], col. 5 line 25 – col. 6 line 13) and 3 (corresponding to the machining of microasperities [406], col. 6 lines 18-62).

Regarding claim 10, Taylor teaches electropolishing of a metal surface using a pulsed current where the pulsed current/voltage comprisies an anodic pulse (unipolar pulse) followed by a cathodic pulse (inverse of the unipolar pulse, Zhou et al. col. 4 line 62 – col. 5 line 19) while maintaining a gap between a workpiece and an opposing

electrode (col. 2 lines 59-67, Zhou et al. col. 11 line 45-49), and further teaches a two step machining process where the initial pulse duration and amplitude differs from the second such that it can more effectively machine different size asperities on the workpiece by initially setting the conditions to machine larger asperities (shown in figure 4A macroasperities [404] and microasperities [406]) and then adjusting then adjusting the pulse duration and amplitude to machine microasperities [406] most effectively with corresponding waveform profiles shown in figures 2 (corresponding to the initial machining of macroasperities [404], col. 5 line 25 – col. 6 line 13) and 3 (corresponding to the machining of microasperities [406], col. 6 lines 18-62), an operational parameter is set for the height of the macroasperities to be less than about 100 micrometers and the workpiece is eroded via anodic pulses (inverse polarity) until an optimal height of the macroasperities has been taken below the target height (col. 4 line 51 – col. 5 line 37).

Regarding claim 13, Taylor teaches a means for measuring a height of asperities on a workpiece (operational parameter) of a workpiece (col. 4 line 51 – col. 5 line 24), a calibration means is applied to test samples prior to machining to resolve the optimum pulse waveform parameters (Zhou et al. col. 13 lines 31-53) this calibration is done with respect to measured surface conditions (rough, dull, smooth, shiny), which corresponds to the height of asperities on the workpiece (rough having large asperities and shiny having very small asperities, Zhou et al. col. 11 lines 33-67), the optimal anodic duty cycle and frequency data is stored (figures 4-7) and is related to the surface condition (rough, dull, shiny, smooth) of the machined test sample, which corresponds to the height of asperities across the workpiece (Zhou et al. col. 13 lines 14-54), asperity

heights (operational parameter) are moniotored and measured until they reach about 100 micrometers (col. 5 lines 25-37) and compared between the actual asperity height and a predetermined stop point for the asperity heights (less than 100 micrometers) an optimal anodic pulse waveform (inverse polarity) is chosen and applied from a set of stored pulse conditions based on the machining needs (duty cycles no greater than 50%, pulse train on/off times 10 microseconds to 500 milliseconds, pulse widths of 0.1 microseconds to 100 milliseconds) until the predetermined operational parameter is met (asperity height) (col. 5 line 25 – col. 5 line 13).

Regarding claim 14, Taylor teaches electrochemical machining of a workpiece (col. 2 lines 45-67) and teaches all the elements of the control system mentioned in claim 13.

Regarding claim 15, Taylor teaches the control system of claim 13 and teaches storing data while calibrating the optimal pulse duration, frequency, and amplitude of a workpiece (Zhou et al. col. 13 lines 14-48) using a program store on a computer to control the system is inherent.

Claims 2-9 and 11-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Taylor (6,558,231) as applied to claim 1 above, and further in view of Gimaev et al. (5,833,835).

Regarding claim 2, 11, and 12, Taylor teaches applying anodic pulses (inverse polarity) having a range of amplitudes and duration in order to remove depositions on a workpiece (col. 5 line 38 – col. 6 line 13) and experimentally determining the removal rate so as to calibrate an optimal pulse duration, frequency, and amplitude by using a

clean metallic sample and measuring a depth of the depression of the machined test sample (example 1) but fails to disclose calibrating the pulse durations by depositing a material on a clean metal sample and storing those deposition heights in order to find a suitable pulse having the inverse polarity to remove the deposited material.

Gimaev et al. teaches electrochemically machining a conductive workpiece using bipolar electrical pulses (abstract). Gimaev et al. teaches finding an optimum amplitude of a pulse current by applying a series of increasing cathodic voltage (cathodic operation parameter) pulses of increasing intensity allowing for deposition of a metal (cathode depositions selected as a variable) measured, which is representative of a property of a gap between an electrode and workpiece these cathodic amplitudes are proportional to voltages of an opposite polarity (inverse polarity) representative of a machining rate (col. 1 line 62 – col. 2 line 30). Gimaev et al. further teaches that by using a prior test to determine the optimum limits it allows for high machining efficiency (col. 1 line 62-67).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to use the test taught by Gimaev et al. to find the optimum pulse amplitude by initially cathodically depositing a metal on a clean metal surface and use the calibration means in the pulse amplitude, frequency, and duration calibration method taught by Taylor because it would allow for higher machining efficiency.

Regarding claim 3, Taylor further teaches machining samples using unipolar (anodic) machining pulses in order to yield a range of surface conditions (rough, smooth, dull, shiny) (Zhou et al. col. 11 lines 15-20, col. 11 lines 51-65, table 1-2), and

assigning various variables to the yield surface conditions (d, w, d/w, mass loss, table 1 and 2), the anodic pulse waveform (inverse polarity) having a pulse duration allows for removal of surface conditions initial surface conditions (Zhou et al. col. 13 line 49 – col. 14 line 14), and providing for a means of comparing d/w (variables) to the anodic duty cycle, which shows the relationship to anodic duty cycle time and yielded surface conditions (Zhou et al. col. 13 lines 31-49).

Regarding claim 4, Taylor teaches applying an anodic pulse waveform (shown in figure 2, unipolar) until the surface conditions of the larger asperities are reduced in height so as to be microasperities (col. 5 lines 25-59), and setting a limit of the height (operational parameter) of macroasperities to denote the end of the first machining step (col. 5 lines 31-37), the height (operational parameter) of the macroasperities is measured in micrometers preferably less than about 100 micrometers (col. 5 lines 31-37), once the macroasperities have reached the target height (first condition) a second anodic pulse waveform is applied to the workpiece until a second condition is met and a final surface roughness is reached with asperities less than 0.1 micrometers (second measurement) (col. 6 lines 18-37), and the pulse duration, amplitude, and frequency can be calibrated for this process (Zhou et al. example 1)

Regarding claim 5, Taylor teaches the height of macroasperities [404] and microasperities [406] is the variable that characterizes the surface condition of the electrode (col. 4 lines 40-50, figures 4A-C).

Regarding claims 6 and 9, Taylor teaches using a cathodic current/potential as a parameter as an operational parameter (Zhou et al. col. 5 lines 20-42) and discusses a

Fourier transform harmonic like pulsing of the current applied to the workpiece (Zhou et al. figure 1) and using this harmonic motion as the operational parameter during machining of the workpiece (col. 5 lines 20-42).

Regarding claims 7 and 8, Taylor teaches plotting results during calibrating a machining process corresponding to the anodic duty cycle and frequency (interval between unipolar machining pulses) and using the results of the plots (slope and area under the curves) to select an optimal operational parameter during machining (Zhou et al. col. 13 lines 14-48).

(10) Response to Argument

Appellant argues:

In regards to claim 1, prior art does not teach or disclose wherein during an optimal mode an optimal duration of the pulses of the inverse polarity is selected, optimal duration being determined from a first calibration carried out preceding the machining of the workpiece and a second calibration carried out during the machining of the workpiece; furthermore, Taylor does not discuss a calibration. In regards to claims 10 and 13, Appellant argues that the prior art does not meet the claimed limitations for the same reason as in claim 1.

Examiner responds:

In regards to claims 1, 10 and 13, Taylor (col. 2, lines 59-63) refers to Zhou et al. (that is incorporated by reference) discloses such a first experimentation to determine optimal pulse parameters before the machining of a workpiece, including duration and duty cycle (Zhou et al., col. 13, lines 31-53) in order to improve machining accuracy. It

is noted that Zhou et al. does not explicitly use the word "calibration," however, experimentation directed towards improving accuracy of machining by varying the above pulse parameters would be such a calibration. A second experimentation is performed by Taylor during the machining of the workpiece by experimenting to reach a predetermined operational parameter, such as asperity hieght., of which a set of stored pulse conditions based on the machining needs are chosen from (col. 5, line 25 to col. 6, lines 13). It is noted that Taylor does not explicitly use the word "calibration," however, experimentation directed towards determined the correct balance between rate of polishing and ultimate process would be such a calibration (col. 6, lines 2-4), and that experimentation is necessary to achieve the right combination of pulse rate, pulse width and duty cycle for the optimum commercial setting (col. 6, lines 9-13).

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

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